REMARKS

Claims 1-99 are pending in the application. Applicants acknowledge the election of claims 1-99 in the Response to Restriction filed September 27, 2005.

Applicants respectfully request the that Examiner indicate on the record whether the drawings submitted with the application have been accepted or advise of any objection.

Allowed and Allowable Subject Matter

Applicants acknowledge allowance of claims 33 to 81.

Applicants further acknowledge the indication of allowable subject matter in dependent claims 7-16, 22, 88 and 90.

Rejections under 35 U.S.C. §102

Reconsideration is respectfully requested of the rejection under 35 U.S.C. §102(b) of claims 1-6, 17-21, and 26-28 as anticipated by the disclosure in U.S. Publication No. 2001/0003672 A1 (Inoue et al.).

Independent claim 1 is directed to an etching process for removing silicon from the surface of a silicon wafer. The claimed process comprises contacting the surface of the silicon wafer with a caustic etchant in the form of an aqueous solution comprising water and a source of hydroxide ions. The concentration of water in the caustic etchant is required to be less than 45% by weight.

In order to anticipate under 35 U.S.C. §102, the cited reference must teach every element of the claim (See MPEP 2131). Applicants respectfully submit that Inoue et al. fail to disclose a silicon wafer etching process utilizing a caustic etchant in the form of an aqueous solution comprising a source of hydroxide ions and having a water concentration of less than 45% by weight.

Inoue et al. describe surface treating and polishing compositions having a resistivity of at most 0.1 Ω-cm suitable for

surface treatment of silicon wafers. The surface treating and polishing compositions comprise water and an additive selected from an alkali metal hydroxide (e.g., potassium hydroxide or sodium hydroxide), an alkali metal carbonate, an alkali metal hydrogencarbonate, a quaternary ammonium salt (e.g., tetramethylammonium hydroxide, tetraethylammonium hydroxide or tetrabutylammonium hydroxide), a peroxide, and a peroxo acid salt. The polishing composition further comprises an abrasive. The concentration of the additive in the compositions disclosed by Inoue et al. is generally from 0.001 to 50 wt%, based on the total weight of the composition. When the composition is used for stock removal polishing, the alkali metal hydroxide additive is preferably present in the polishing composition at a concentration of from 0.001 to about 30 wt%, more preferably from 0.01 to 5 wt%, and most preferably from 0.05 to 3 wt% and the quaternary ammonium salt additive is preferably present in the polishing composition at a concentration of from 0.05 to 15 wt%, more preferably from 0.1 to 10 wt %, and most preferably from 0.05 to 5 wt%. Suitable abrasives disclosed by Inoue et al. include colloidal silica, fumed silica, or precipitated silica and the abrasive is present in the polishing composition at a concentration of from 0.01% to 50 wt%, preferably from 0.05% to 30 wt%, and more preferably from 0.1% to 20 wt%, based on the total weight of the composition.

The Office action contends that Inoue et al. discloses an etching process utilizing a caustic etchant as defined in claim 1 (i.e., an aqueous solution comprising water and a source of hydroxide ions in which the concentration of water is less than 45% by weight) on the basis of the disclosure in the cited reference of a polishing composition comprising water, 0.01 to 50 wt% abrasive and 0.001 to 30 wt% of an alkali metal hydroxide. Applicants respectfully submit the broad disclosure of Inoue et al. relied on by the Examiner does not disclose the caustic etchant utilized in the process of claim 1. In particular, the disclosure in the cited

reference of polishing compositions comprising water, abrasives, candidate additives, and their general and preferred concentration ranges fails to teach a single embodiment of a caustic etchant in the form of an aqueous solution comprising water and a source of hydroxide ions in which the concentration of water in the caustic etchant is less than 45% by weight as required in the process of claim 1. Contrary to the implication in paragraph 4 bridging pages 2 and 3 of the Office action, Inoue et al. do not disclose an embodiment of the polishing composition containing 50% by weight of an abrasive, 30% by weight of an alkali metal hydroxide and, therefore, 20% by weight water. Rather, the broad disclosure in Inoue et al. is that the concentration of the abrasive in the polishing solution can vary from 0.01 to 50 wt%, while the concentration of alkali metal hydroxide can independently vary from 0.001 to 30 wt% with no teaching or suggestion that a high abrasive content be combined with a high concentration of alkali metal hydroxide or other source of hydroxide ions to thereby necessarily obtain a water content of less than 45% by weight. Indeed, to the extent that the cited reference teaches more preferred concentration ranges for the abrasive and alkali metal hydroxide components of the polishing composition (preferably from 0.1 to 20 wt% abrasive and most preferably 0.05 to 3 wt% alkali metal hydroxide), the water content of the polishing composition would exceed 70 wt%.

None of the Examples provided by Inoue et al. disclose the etching process defined in claim 1. The polishing compositions of Examples 1 through 6 and 9 through 13 including water, an abrasive and a source of hydroxide ions (KOH, NaOH or TMAH 3.6% solution) were prepared by adding the hydroxide source additive to an aqueous slurry containing 2 wt% of the colloidal silica abrasive in the amounts indicated in Table 1. Similarly, the polishing compositions of Examples 16 through 30 including water, an abrasive, a source of hydroxide ions (KOH or TMAH 3.6% solution)

and a water-soluble polymer were prepared by adding the hydroxide source additive and water-soluble polymer to an aqueous slurry of colloidal silica. The amount of the hydroxide source additive and water-soluble polymer added and the abrasive concentration of the starting slurry are set forth in Table 2. Applicants submit that the water content of the polishing composition in each of these Examples greatly exceeds 45% by weight.

Accordingly, the disclosure of Inoue et al. fails to anticipate the invention defined in claim 1. Applicants further submit that claims 2-6, 17-21, and 26-28, which depend directly or indirectly from claim 1, are likewise novel over the cited reference for the reasons set forth above with respect to claim 1 and in view of the additional limitations set forth therein.

Rejections under 35 U.S.C. §103(a)

Claims 23-25 and 29

Reconsideration is respectfully requested of the rejection of claims 23-25 and 29 under 35 U.S.C. §103(a) based on the disclosure of Inoue et al. in view of the disclosure in U.S. Patent No. 6,099,748 (Netsu et al.)

Claims 23, 24, and 25 depend directly or indirectly from claim 1 and require that the temperature of the caustic etchant contacted with the silicon wafer be at least about 70°C, from about 70°C to about 120°C, and from about 75°C to about 85°C, respectively. Claim 29 depends indirectly from claim 1 and requires that the wafer be immersed in the caustic etchant for a time such that the amount of silicon removed from the surface of the wafer is from about 10 μm to about 30 μm in terms of total thickness from both the front and back surface of the wafer.

In order to establish a *prima facie* case of obviousness, the Patent Office must establish, *inter alia*, that the combination of the cited references teaches or suggests all the claim limitations (See MPEP 2143.03).

Netsu et al. disclose a method for etching silicon wafers using an etchant in the form of an alkali aqueous solution that contains an alkali component in a concentration of from 50.6% to 55.0% by weight. Preferably, the alkali component is sodium hydroxide. Netsu et al. generally describe a conventional etching process and sets forth various parameters for the process (e.g., temperature the etchant contacted with the wafer). However, the teaching of Netsu et al. does not overcome the deficiency of Inoue et al with respect to the requirement in claim 1 of utilizing a caustic etchant in the form of an aqueous solution comprising a source of hydroxide ions and containing less than 45% by weight water. Accordingly, applicants respectfully submit that, even assuming there is motivation to combine the disclosures of the primary reference with the teaching of Netsu et al., the proposed combination fails to provide a *prima facie* case of obviousness as to dependent claims 23-25, and 29 on the basis of the arguments set forth above with respect to the patentability of claim 1 over the disclosure in Inoue et al.

Claims 30-32

Reconsideration is respectfully requested of the rejection of claims 30-32 under 35 U.S.C. §103(a) based on the disclosure of Inoue et al. in view of the disclosure in U.S. Patent No. 6,793,836 (Tsung-Kuei et al.). Applicants note that the disclosure in U.S. Patent No. 6,793,836 and corresponding Publication No. US 2003/0196986, both published after the September 18, 2003 filing date of the subject application, are potentially prior art against the subject application under 35 U.S.C. §102(e).

Dependent claims 30-32 depend directly or indirectly from claim 1. Dependent claim 30 requires that the surface of the wafer be contacted with the caustic etchant by spraying the surface of the wafer with the caustic etchant. Further dependent claims 31 and 32 require that the wafer be rotated while its surface is

sprayed with the caustic etchant and that the rate of rotation of the wafer be from about 50 revolutions per minute to about 650 revolutions per minute.

Tsung-Kuei et al. describe a puddle etching process for use in the processing of semiconductor wafers which includes spinning of the wafers. However, the teaching of Tsung-Kuei et al. does not overcome the deficiency of Inoue et al with respect to the requirement in claim 1 of utilizing a caustic etchant in the form of an aqueous solution comprising a source of hydroxide ions and containing less than 45% by weight water. Accordingly, applicants respectfully submit that, even assuming there is motivation to combine the disclosures of the primary reference with the teaching of Tsung-Kuei et al., the proposed combination fails to provide a *prima facie* case of obviousness as to dependent claims 30-32 on the basis of the arguments set forth above with respect to the patentability of claim 1 over the disclosure in Inoue et al.

Claims 82-87, 89, and 91-99

Reconsideration is respectfully requested of the rejection of claims 82-87, 89, and 91-99 under 35 U.S.C. §103(a) based on the disclosure of Inoue et al.

Independent claims 82 and 99 define etching processes for removing silicon from the surface of a silicon wafer that comprise contacting the surface of the silicon wafer with a caustic etchant in the form of an aqueous solution comprising water, hydroxide ions, and a salt additive that does not decompose or react in the caustic etchant. In the process of claim 82, the salt additive comprises a compound selected from the group consisting of inorganic alkali and alkaline earth metal salts and mixtures thereof and the concentration of the salt additive in the caustic etchant is at least about 4 mole percent. In the process of claim 99, the salt additive comprises a compound selected from the group consisting of potassium carbonate and potassium fluoride and the

concentration of the salt additive in the caustic etchant is at least about 1 mole percent.

In order to establish a *prima facie* case of obviousness, the Patent Office must establish, *inter alia*, that the cited reference teaches or suggests all the claim limitations (See MPEP 2143.03).

The Examiner contends that the broad disclosure of Inoue et al. discussed above of various additives for polishing and surface treatment compositions and general and preferred concentration ranges of these additives teaches or suggests the caustic etchants utilized in the processes of independent claims 82 and 99. In particular, the Examiner apparently relies on the general disclosure of an additive concentration of from 0.001 to 50 wt% and the teaching of an alkali metal hydroxide (e.g., sodium hydroxide), carbonate or hydrogencarbonate additive concentration of preferably from 0.001 to 30 wt%, as teaching or suggesting an etching solution containing 50 wt% water, 30 wt % sodium hydroxide and 20 wt% potassium carbonate, which correlates to a calculated water concentration of about 75 mole percent, a sodium hydroxide concentration of about 20 mole percent and a potassium carbonate concentration of about 4 mole percent. As explained in detail below, the disclosure in Inoue et al. contains no such teaching or suggestion.

The processes of claims 82 and 99 utilize a caustic etchant comprising water, hydroxide ions and a salt additive selected from the group consisting of inorganic alkali and alkaline earth metal salts and mixtures thereof (e.g., potassium carbonate or potassium fluoride in claim 99). Applicants acknowledge that among the myriad of additives for inclusion in the polishing and surface treating compositions of Inoue et al. are mentioned both alkali metal carbonate salts such as potassium carbonate and sodium carbonate and hydroxide ion sources such as alkali metal hydroxides and quaternary ammonium hydroxide salts and that the cited reference mentions that these additives may be used in combination

(See paragraph 0029). However, the vast majority of the disclosure in Inoue et al. does not contemplate the use of more than one of the disclosed additives, nor or any specific combinations of the disclosed additives taught or suggested. In any event, among the numerous possible combinations of the six types of disclosed additives, Inoue et al. do not teach or suggest the specific combination of a hydroxide ion source additive with an alkali metal carbonate additive in accordance with the process of claims 82 and 99. None of the polishing compositions described in the 30 Examples of Inoue et al. include the combination of a hydroxide ion source additive with an inorganic alkali or alkaline earth metal salt. In the two Examples that include potassium carbonate as an additive in the polishing composition (Examples 7 and 8), the polishing composition does not include hydroxide ions or, for that matter, any of the other additives disclosed by Inoue et al.

Moreover, to the extent that Inoue et al. teach generally that the various additives may be used in combination, the reference provides no teaching or suggestion that would motivate one skilled in the art to select for combination an alkali metal carbonate and hydroxide ion source additives along with abrasive and water in such proportions to obtain a caustic etchant containing the minimum salt additive content recited in claim 82 (at least about 4 mole percent of the inorganic alkali metal salt) or claim 99 (at least about 1 mole percent of potassium carbonate). In paragraphs 30 and 46 of the Office action, the Examiner inexplicably has combined the general disclosure in Inoue et al. of an additive content from 0.001 to 50 wt%, based on the total weight of the composition (See paragraph 0029), with the separate specific disclosure pertaining to the situation "when the additive is an alkali metal hydroxide, carbonate or hydrogencarbonate" the concentration of the additive is from 0.001 to 30 wt% (See paragraph 0030) and then subtracted the upper end of the latter disclosed range from the upper end of the general range to arrive at a potassium carbonate content of 20%

by weight. As emphasized in the above-quoted disclosure in paragraph 0030 of Inoue et al., the concentration range of from 0.001 to 30 wt% pertains to a single additive selected from alkali metal hydroxide, carbonate or hydrogencarbonate and does not teach or suggest the composition purported in the Office action including both sodium hydroxide and potassium carbonate. Inoue et al. contains no teaching whatsoever of an etchant containing the combination of a hydroxide ion source and an inorganic alkali or an alkaline earth metal salt additive in such proportions with water so as to obtain the minimum salt additive concentration recited in either claim 82 or 99.

In view of the above, applicants respectfully submit the disclosure of Inoue et al. fails to establish a *prima facie* case for obviousness of the processes defined in either claims 82 or 99. The processes defined in dependent claims 83-87, 89 and 91-98, which depend directly or indirectly from claim 82, are likewise submitted as patentable over Inoue et al. for the reasons set forth above with respect to claim 82 and the additional limitations set forth therein.

Favorable reconsideration and allowance of all pending claims are respectfully solicited. Applicants do not believe any fees are due with the timely submission of this Letter. However, the Commissioner is requested to charge any fee deficiency in connection with this Letter to Deposit Account No. 19-1345.

Respectfully submitted,

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